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SHORT COMMUNICATION

Records of melanistic *Tamandua tetradactyla* (Pilosa, Myrmecophagidae) from Ecuador

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Abstract

In Ecuador, the presence of melanistic individuals of Southern Tamandua *Tamandua tetradactyla* Linnaeus (1758) has been recognized but there has not been a formal report written about it. Neither has there been one on the observations or the collected specimens in museums. We present six records of melanism in *Tamandua tetradactyla* from southern Ecuador and discuss other records in wildlife and from museum collections. Half of the records are recent photographic ones (2018), and the other three are museum specimens collected between 2009 and 2016. Our report of melanistic individuals suggests that dark coloration varieties are frequent mutations in the region. This report can be useful to promote conservation initiatives, based on the Southern Tamandua as a potential flagship-species.

Resumo

A existência de indivíduos melânicos do tamanduá-mirim, *Tamandua tetradactyla* Linnaeus (1758) é reconhecida no Equador. No entanto, não existe até o momento um registro formal das observações e dos espécimes depositados nas coleções científicas. Neste trabalho recopilamos e discutimos os registros fotográficos de indivíduos melânicos do tamanduá-mirim registrados em vida silvestre e dos espécimes depositados nas coleções. Apresentamos seis registros de melanismo em *Tamandua tetradactyla*, com uma variação de coloração completamente escura, a partir do Sul do Equador. Metade

dos registros é composta por fotografias recentes (2018) e os outros três são espécimes coletados e depositados entre 2009 até 2016. Nossas observações sugerem que a coloração escura pode ser frequente na região. Este trabalho promove as iniciativas de conservação com base em indivíduos melânicos do tamanduá-mirim como uma potencial espécie emblemática.

Keywords
Cerro Plateado Biological Reserve, color variation, neotropical mammals, Podocarpus National Park, Xenarthra, Vermilingua

Palavras-chave
Reserva Biológica Cerro Plateado, variação de coloração, mamíferos neotropicais, Parque Nacional Podocarpus, Xenarthra, Vermilingua

The Myrmecophagidae family includes three medium to large anteaters characterized by having four digits with claws on the forefeet (Gardner 2008). One of them is the Southern Tamandua (*Tamandua tetradactyla*), which is distributed in South America, from the Guianas to northern Argentina, including the whole of the Amazon basin (Wetzel 1975; Gardner 2005; 2008; Hayssen 2011). In Ecuador, it occurs from the eastern foothills of the Andes to the Amazon basin, from 200 to 1,650 m a.s.l. This species has been recorded occupying a wide variety of habitats, from well-preserved rainforest to open areas (Aguiar 2004; Tirira 2017). Its coloration is commonly yellowish and could present a distinctive dark mark like a necklace or vest shape (Wetzel 1975; Hayssen 2011); there are also records of individuals with dark brown (*i.e.*, chocolate) and completely black colorations (Allen 1904; Meritt 1975; Wetzel 1975; Hayssen 2011). Melanistic individuals were formerly treated as *Tamandua tetradactyla nigra* or *T. t. quichua* (Menegaux 1902; Wetzel 1975; Gardner 2008); nowadays there is no exclusive subspecies nomination for melanistic individuals. Currently, there are four recognized subspecies: *tetradactyla*, *nigra*, *quichua* and *straminea*, each one associated with a particular distribution (Gardner 2005, 2008).

To date, there has not been an appropriate report of a melanistic Southern Tamandua observed in Ecuador (Tirira 2017). Melanism is a phenomenon of genetic causes, which produces darkly pigmented phenotypes (Kingsley et al. 2009); if this coloration favors the species fitness, it could be fixed in the population by Darwinian selection (Majerus and Mundy 2003) or because of genetic drift in reduced wildlife populations (Lande 1976). This paper is the first formal report on melanism in *T. tetradactyla* in Ecuador (Fig. 1).

We report six records of melanism in *Tamandua tetradactyla* from southern Ecuador, in the Zamora Chinchipe and Morona Santiago provinces. Three are recent photographic records obtained in 2018 and the other three are museum specimens collected in 2009, 2012 and 2016. Our first record was made during the landscape scale monitoring to estimate the population abundance of focal species of large and medium-sized mammals within the National System of Protected Areas of Ecuador (Ministerio del Ambiente del Ecuador, Proyecto Paisajes – Vida Silvestre). The record

Figure 1. *Tamandua tetradactyla* recorded in the southern part of Podocarpus National Park, Ecuador: **a)** Melanistic individual recorded in a camera trap placed in the surroundings of the San Luis waterfall; **b)** An individual with yellowish coloration observed during the monitoring, photo: HC; **c)** Melanistic individual observed in the Loja – La Balsa E682 road, photo: E. Moreno; **d)** road-killed melanistic specimen photographed in the E45 road in Limón Indanza, Morona Santiago, photo: C. Jara

was documented by a camera trap on March 9, 2018, at 00:58h. The camera was placed on a wildlife trail in a mountain forest (4°32'56.36"S, 79°3'18"W; 1,391 m a.s.l.), in the surroundings of the San Luis waterfall, Porvenir del Carmen, Zamora Chinchipe (sampling effort 33 trap-nights) (Fig. 2). Our second record occurred during the usual patrol of the park rangers of the Podocarpus National Park. It was on October 10, 2018 at noon, at a straight-line distance of 21 km from the previous record, in the Loja – La Balsa E682 road, Zamora Chinchipe (4°43'31.77"S, 79°7'19.13"W; 1184 m a.s.l.), which crosses wooded and disturbed areas, in a terrain characterized by steep slopes and rugged topography (Fig. 2). The third record was made by C. Jara; he took a photo of a road kill melanistic specimen in E45 road, Limón Indanza, Morona Santiago (4°43'31.77"S, 79°7'19.13"W; 1184 m a.s.l.) on October 23, 2018, at a straight-line distance of 185 km from our camera trap record (Fig. 2).

In addition, we found three *T. tetradactyla* melanistic specimens from museums in Ecuador. Two specimens were found dead after having been run over and were collected. One was from General Leonidas Plaza Gutiérrez locality, Limón Indanza, Morona Santiago, collected on February 2, 2009 (Museo de Zoología de la Pontificia

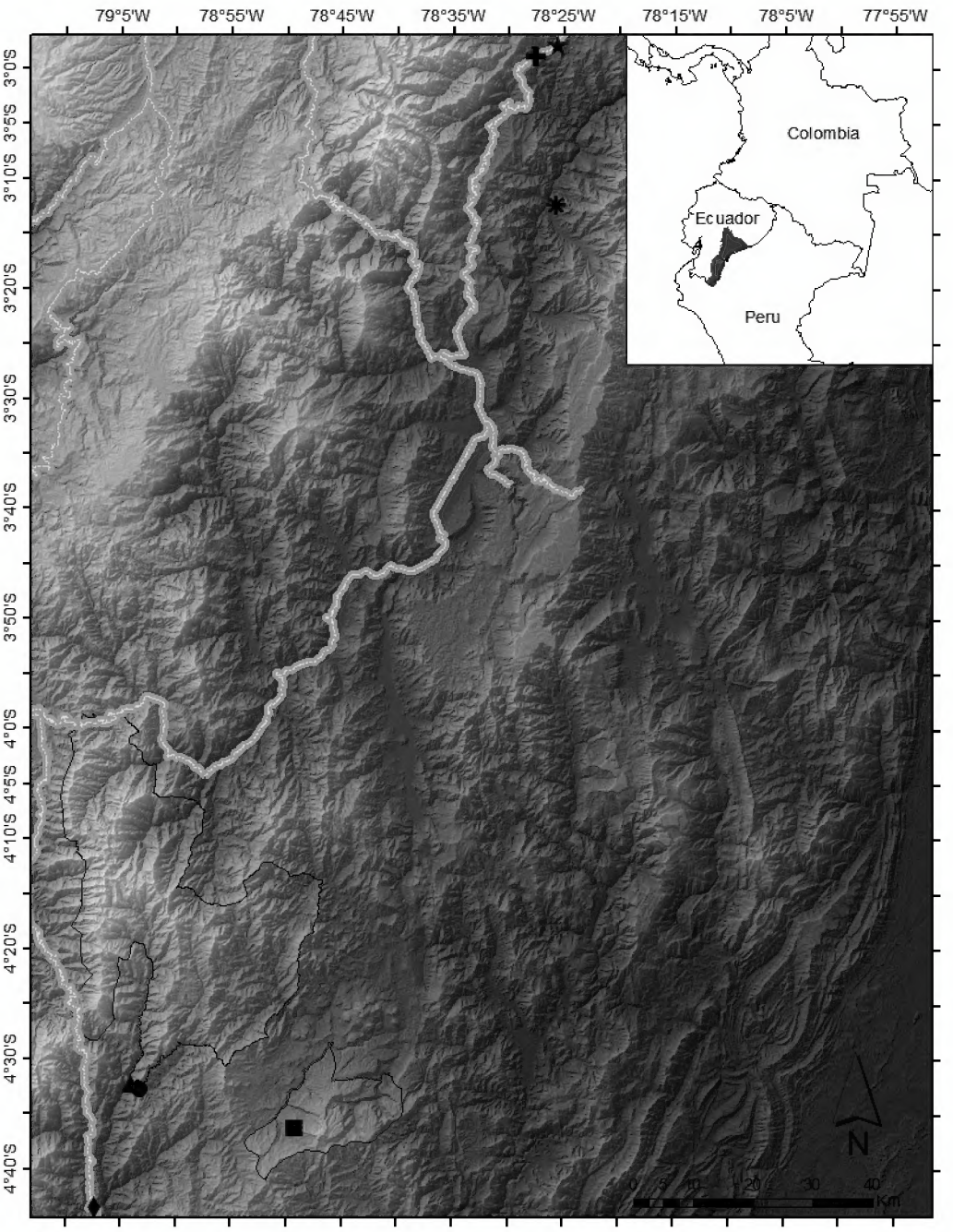

Figure 2. Records of melanistic *Tamandua tetradactyla* in Ecuador. Photographic records: Circle: individual recorded in the camera trap, San Luis waterfall, 2018; triangle: yellowish individual observed during the monitoring, 2018; diamond: individual photographed in the Loja – La Balsa E682 road, 2018; cross: road-killed individual, Limón Indanza, 2018. Museum specimens: star: QCAZM-10957, General Leonidas Plaza Gutiérrez, 2009; square: MEPN 12228, Cerro Plateado Biological Reserve, 2012; asterisk: MECN 5285, San Juan Bosco, 2016. Black solid lines: Podocarpus National Park at the north and the Cerro Plateado Biological Reserve at southeast; gray-shaded dashed line: Ecuadorian state road network.

Universidad Católica del Ecuador, QCAZM 10957), and the second was from San Juan Bosco, Morona Santiago (Museo Ecuatoriano de Ciencias Naturales, MECN 5285), collected in March 2016. The third specimen was a female collected near Cerro Plateado Biological Reserve, Alto Nangaritza, Zamora Chinchipe on August 27, 2012 (Museo de la Escuela Politecnica Nacional, MEPN 12228). These specimens were collected at a straight-line distance of 188.4 km, 164 km and 26.8 km from our camera trap record, respectively (Fig. 2). There have been some records of Southern Tamandua in their distribution range in Ecuador (Table 1). Based on the museum collections we accessed, the proportion of melanistic individuals is around

Table 1. Southern Tamandua specimens collected in Ecuador.

Source	Date of collection (mm/dd/yy)	Coloration		Coordinates
		Melanic	Non-melanic	
MEPN-8074	–		x	–
MEPN-10799	2/1/1956		x	01°34'S, 76°21'W
MEPN-10800	1/8/1969		x	00°27'S, 77°53'W
MEPN-10802	–		x	–
MEPN-12228*	8/27/2012	x		4°36'21.70"S, 78°49'11.91"W
MECN-1027	–		x	0°45'33.38"S, 76°36'38.69"W
MECN-5285*	3/-/2016	x		3°12'23.76"S, 78°25'45.53"W
QCAZM-1038	–		x	0°24'28.44"S, 76°37'14.16"W
QCAZM-1040	–		x	0°1'59.99"S, 77°30'0.00"W
QCAZM-3374	10/24/1999		x	0°38'19.31"S, 77°26'0.60"W
QCAZM-3393	8/8/1999		x	0°38'19.31"S, 77°26'0.60"W
QCAZM-3846	2/26/2008		x	–
QCAZM-10957*	1/25/2009	x		2°57'52.24"S, 78°25'40.08"W
MZUA-MA313	2/-/2014		x	2°58'21.96"S, 78°13'37.48"W

(*) Specimens here reported. MEPN: Museo de la Escuela Politécnica Nacional; MECN: Museo Ecuatoriano de Ciencias Naturales; QCAZM: Museo Zoología de la Pontificia Universidad Católica del Ecuador; MZUA: Museo de Zoología de la Universidad del Azuay.

21% of total individuals collected. Nonetheless, there are not enough specimens collected (n= 14), or formally reported, to compare the ratio between coloration varieties in Ecuador. Besides, there is a lack of sampling effort regarding the species because of the poor species-specific studies developed to date.

Our records agree with the natural distribution, habits and activity cycles reported for the species (Meritt 1975; Montgomery 1985; Wetzel 1985; Pérez-Jimeno 2003; Aguiar 2004; Aguiar and Da Fonseca 2008; Superina et al. 2010). Melanistic individuals have been recorded from French Guiana, to the Amazon basin and through to the eastern foothills of Ecuador and Peru. These observations match the distribution areas of a high incidence of melanism and variations in the dark vest-shaped mark (Allen 1904; Menegaux 1902; Meritt 1975; Wetzel 1975), suggesting processes of genetic differentiation or speciation that have not been yet clarified. *Tamandua tetradactyla* have low encounter frequencies because of their low densities in wildlife (Arita et al. 1990; Tirira 2017), and primarily depended on the distribution and abundance of their food resources (Gallo et al. 2017; Toledo et al. 2017). We had only three observations in an area of around 300 km^2. Two of them were the melanistic individuals reported here, and the third was direct observation of an individual with yellowish coloration without the dark coloration of necklace or vest shape, at a straight-line distance of 1.7 km from our first melanistic record. We assumed them to be three different individuals based on: (1) their fur coloration; (2) the mean home range area reported (1–3.75 km^2); and, (3) the mean daily distance of movement for the species (3000 m), which is a far shorter distance than that between our observations (Montgomery and Lubin 1977; Montgomery 1985; Rodrigues et al. 2001; Rodrigues et al. 2008). This confirms the co-occurrence of normal colored and melanistic individuals of the species in this locality (Fig. 2).

There is scarce information on the species in Ecuador (Tirira 2017), even more so with respect to the prevalence and ecological fitness of color variations in wildlife populations. In Peru there have been successful breeding experiences between melanistic and yellowish individuals, with a wide range of colors in the offspring, including individuals with dark brown coloration (*i.e.*, chocolate) (G. Rojas com. pers.). Nonetheless, to date, our report has been the only communication containing observations on melanistic individuals of Southern Tamandua in Ecuador. Our report is a contribution to update the natural history and distribution patterns of *T. tetradactyla*, particularly when recent studies indicate a potentially new species of the genus (Pereira-Júnior et al. 2004). In addition, in its sister clade *Cyclopes*, the fur coloration is considered a diagnostic character to determine the species classification (Miranda and Superina 2010). Here we report seven independent observations of the Southern Tamandua, between 2009 and 2018; six of which were from melanistic individuals. Our report shows an apparently high incidence of melanistic individuals in the region, and according to previous observations, it supports the high frequency of dark coloration individuals in these populations (Wetzel 1975). However, it is necessary to develop a population genetic study of these to assess the rates of melanism and to identify the origins of this variation. In addition, although there are other records of melanistic Southern Tamandua, we could not include all of them due to the lack of formal reports, uncertain associated information and poor reported observations of independent environmental studies and government agencies.

Commonly, the flagship species approach had been focused on charismatic animals with the potential ability to raise both funds and awareness about nature conservation (Walpole and Leader-Williams 2002). We believe this report strengthens the conservation initiatives based on a flagship-species approach because of the charismatic importance of the melanistic Southern Tamandua and its potential ability to represent an iconic and unique mammal species in Ecuador. Even more so in such an important, under-explored and highly threatened region like Alto Nangaritza and Cordillera del Cóndor, where the growing mining exploitation justifies the road opening and the consequent human colonization (Laurance et al. 2009; Guayasamín and Bonaccorso 2013; Reyes-Puig et al. 2017). The present study also highlights the danger of the roads for wildlife, since four records were on roads and, in three cases, the individuals had been run over and killed. The conservation of the species of the superorder Xenarthra entails the conservation of the most representative lineage of mammals in South America, characterized by a unique evolutionary history (Vizcaíno and Bargo 2014).

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References

Aguiar JM (2004) Species summaries and species discussions. In: Fonseca G, Aguiar J, Rylands A, Paglia A, Chiarello A, Sechrest W (Eds) The 2004 Edentate Species Assessment Workshop. Edentata 6: 3–26. https://doi.org/10.1896/1413-4411.6.1.3

Aguiar JM, Da Fonseca GAB (2008) Conservation status of the Xenarthra. In: Vizcaino SF, Loughry WJ (Eds) The Biology of the Xenarthra. University Press of Florida, Gainesville, 215–231.

Allen JA (1904) The Tamandua anteaters. Bulletin of the American Museum of Natural History 20: 385–398. http://digitallibrary.amnh.org/bitstream/handle/2246/671//v2/dspace/ingest/pdfSource/bul/B020a33.pdf?sequence=1&isAllowed=y

Arita HT, Robinson JG, Redford KH (1990) Rarity in Neotropical forest mammals and its ecological correlates. Conservation Biology 4: 181–192. https://doi.org/10.1111/j.1523-1739.1990.tb00107.x

Gallo J, Abba A, Elizalde L, Di Nucci D, Ríos TA, Ezquizaga MC (2017) First study on food habits of anteaters, *Myrmecophaga tridactyla* and *Tamandua tetradactyla*, at the southern limit of their distribution. Mammalia 81(6): 601–604. https://doi.org/10.1515/mammalia-2016-0117

Gardner AL (2005) Order Pilosa. In: Wilson DE, Reeder DM (Eds) Mammal Species of the World: A Taxonomic and Geographic Reference (3rd edn). Johns Hopkins University Press, Baltimore, Maryland, 100–103.

Gardner AL (2008) Mammals of South America, Volume 1: Marsupials, Xenarthrans, Shrews and Bats. The University of Chicago Press, Chicago, 669 pp. https://doi.org/10.7208/chicago/9780226282428.001.0001

Guayasamín JM, Bonaccorso E (2013) A Rapid Biological Assessment of the Tepuis in the Upper Nangaritza River Basin, Cordillera del Cóndor, Ecuador. Conservation International.

Hayssen V (2011) *Tamandua tetradactyla* (Pilosa: Myrmecophagidae). Mammalian Species 43(875): 64–74. https://doi.org/10.1644/875.1

Kingsley EP, Manceau M, Wiley CD, Hoekstra HE (2009) Melanism in *Peromyscus* is caused by independent mutations in Agouti. PLoS One 4(7): e6435. https://doi.org/10.1371/journal.pone.0006435

Lande R (1976) Natural selection and random genetic drift in phenotypic evolution. Evolution – International Journal of Organic Evolution 30(2): 314–334. https://doi.org/10.1111/j.1558-5646.1976.tb00911.x

Laurance WF, Goosem M, Laurance SGW (2009) Impacts of roads and linear clearings on tropical forests. Trends in Ecology & Evolution 24(12): 659–669. https://doi.org/10.1016/j.tree.2009.06.009

Majerus ME, Mundy N (2003) Mammalian melanism: Natural selection in black and white. Trends in Genetics 19(11): 585–588. https://doi.org/10.1016/j.tig.2003.09.003

Menegaux A (1902) Catalogue des mammif `eres rapportés par M. Geay de la Guyane Française en 1889 et 1900. Bulletin du Muséum national d'histoire naturelle, Paris 8: 490–96.

Meritt Jr DA (1975) The lesser anteater, *Tamandua tetradactyla*, in captivity. International Zoo Yearbook 15: 41–45. https://doi.org/10.1111/j.1748-1090.1975.tb01350.x

Miranda F, Superina M (2010) New distribution records of the silky anteater Cyclopes didactylus (Pilosa, Cyclopedidae) in coastal northeastern Brazil. Mastozoología Neotropical 17(2): 381–384. http://www.scielo.org.ar/scielo.php?script=sci_arttext&pid=S0327-93832010000200013

Montgomery GG (1985) Movements, foraging and food habits of the four extant species of Neotropical vermilinguas (Mammalia: Myrmecophagidae). In: Montgomery GG (Ed.) The Evolution and Ecology of Armadillos, Sloths, and Vermilinguas. Smithsonian Institution Press, Washington, D.C., 365–377.

Montgomery GG, Lubin YD (1977) Prey influences on movements of Neotropical anteaters. In: Phillips RL, Jonkel C (Eds) Proceedings of the 1975 Predator Symposium. Montana Forest and Conservation Experiment Station, University of Montana, Missoula, 103–131.

Pereira-Júnior HRJ, Jorge W, Costa MELT (2004) Chromosome study of Anteaters (Myrmecophagideae, Xenarthra): A preliminary report. Genetics and Molecular Biology 27(3): 391–394. https://doi.org/10.1590/S1415-47572004000300014

Pérez-Jimeno G (2003) Crianza Artificial y Manejo Reproductivo de los Tamanduá (*Tamandua tetradactyla*) en el Jardín Zoológico de Rosario, Argentina. Edentata 5: 24–28. http://www.xenarthrans.org/resources/newsletter/Perez%20Jimeno_Crianza%20artificial%20y%20manejo%20reproductivo%20de%20los%20tamandua%CC%81%20(Tamandua%20tetradactyla)%20en%20el%20Jardi%CC%81n%20Zoolo%CC%81gico%20de%20Rosario,%20Argentina.pdf

Reyes-Puig C, Almendáriz AC, Torres-Carvajal O (2017) Diversity, threat, and conservation of reptiles from continental Ecuador. Amphibian & Reptile Conservation 11(2): 51–58. http://amphibian-reptile-conservation.org/pdfs/Volume/Vol_11_no_2/ARC_11_2_[General_Section]_51-58_e147_high_res.pdf

Rodrigues FHG, Marinho-Filho J, Dos Santos HG (2001) Home ranges of translocated lesser anteaters *Tamandua tetradactyla* in the cerrado of Brazil. Oryx 35(2): 166–169. https://doi.org/10.1046/j.1365-3008.2001.00162.x

Rodrigues FHG, Medri IM, De Miranda GHB, Camiloalves C, Mourao G (2008) Anteater behavior and ecology. In: Vizcaino SF, Loughry WJ (Eds) The Biology of the Xenarthra. University Press of Florida, Gainesville, 257–268.

Superina M, Miranda FR, Abba AM (2010) The 2010 Anteater Red List Assessment. Edentata 11(2): 96–114. https://doi.org/10.5537/020.011.0201

Tirira DG (2017) Guía de campo de los mamíferos del Ecuador. Publicación Especial 11. Asociación Ecuatoriana de Mastozoología y Editorial Murciélago Blanco, Quito, 600 pp.

Toledo N, Bargo MS, Vizcaíno SF, De Luliis G, Pujos F (2017) Evolution of the body size in anteaters and sloths (Xenarthra, Pilosa): Phylogeny, metabolism, diet and substrate

preferences. Earth and Environmental Science Transactions of the Royal Society of Edinburgh 106(4): 289–301. https://doi.org/10.1017/S1755691016000177

Vizcaíno SF, Bargo MS (2014) Loss of ancient diversity of Xenarthrans and the value of protecting extant armadillos, sloths and anteaters. Edentata 15(1): 27–38. https://doi.org/10.5537/020.015.0111

Walpole MJ, Leader-Williams N (2002) Tourism and flagship species in conservation. Biodiversity and Conservation 11(3): 543–547. https://doi.org/10.1023/A:1014864708777

Wetzel RM (1975) The species of Tamandua Gray (Edentata, Myrmecophagidae). Proceedings of the Biological Society of Washington 88: 95–112.

Wetzel RM (1985) The identification and distribution of recent Xenarthra (= Edentata). In: Montgomery GG (Ed.) The Evolution and Ecology of Armadillos, Sloths, and Vermilinguas. Smithsonian Institution Press, Washington, DC, 5–21.